
Incorporating iPad Technology into the Classroom: A Geometry Project

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***Abstract:** Technology is a vital tool that teachers should utilize to help strengthen student understanding. The latest technological tool, the iPad, has the potential to drastically change the way educators present material, and the way students demonstrate their knowledge of subject matter. This article describes in detail a geometry activity done solely on the iPad and explains how the activity is an effective use of technology in the mathematics classroom.*

***Keywords.** technology, tablet computers, geometry*

1 Introduction

Technological advances in the last ten years have dramatically changed society. These advances affect every single aspect of our lives, including education. Technological innovations are changing the way mathematics can be taught. If schools have the funding and support available to embrace new technology, there are new tools available each year to improve the teaching and learning of mathematics.

The National Council of Teachers of Mathematics (NCTM) The Role of Technology in the Teaching and Learning of Mathematics (2011) has outlined goals for incorporating technology into the teaching and learning of mathematics. NCTM believes that technology is an essential tool for learning mathematics in the 21st century, and teachers should use technology to develop students' mathematical understanding and keep them motivated to learn. Technological tools support student learning in every area of mathematics by allowing students to focus on decision making, reflection, reasoning, and problem solving. Technology can also allow students to explore mathematical ideas that may not be possible without technological tools. With the appropriate use of technology, students can learn mathematics more deeply, which is the goal of mathematics education. Finally, technology allows students to be engaged learners, which increases motivation and student achievement. Children in today's society have been using technological tools their entire lives,

and will most likely need to use technology in their future careers, so it makes sense to incorporate these tools into the learning process.

As school districts across the country explore technological innovations, educators and administrators must determine how to incorporate this technology to enhance student achievement. While technology can open doors to new concepts and approaches to solving problems, it can also be challenging to implement. Most teachers agree that incorporating technological tools can benefit students and should be done, but only if the technology is used in a meaningful way. “The purpose of providing technology to schools is to improve student academic performance and other educational outcomes, not to provide state-of-the-art equipment for its own sake” (Wenglinsky, 1998, p. 7). The key for researchers and teachers is finding ways to integrate technology in order to support students’ achievement and foster deeper conceptual learning of mathematical content.

Several strategies exist for using technology effectively in the classroom. Teachers should try to use technology to motivate or generate student interest. When students are motivated, they become engaged and active learners. Another strategy for teachers to consider is to use technology to present material in a novel way. Advances in technology have opened doors to present abstract material in a more understandable manner. Finally, teachers should consider utilizing technology when it allows them to teach more efficiently. Certain tools can allow teachers to better understand their students’ strengths and weaknesses, so that they can alter instruction as necessary.

The most recent technological tool to hit classrooms is the iPad tablet. The iPad, which first came out in 2009, has the potential to completely revolutionize education, with students having constant access to the internet, electronic textbooks, and thousands of educational apps that are helping make the classroom more interactive for students. Whether students are creating videos using iMovie, creating flashcards for their next test, or watching instructional videos, the iPad has the ability to engage all students and help them learn difficult mathematical concepts.

This article will detail a geometry project done exclusively on the iPad. The purpose of this project was to have students create a presentation that would demonstrate their knowledge of geometry vocabulary learned throughout the school year.

2 The Project

This vocabulary project was assigned in the 3rd quarter at a school where each student and faculty member was provided an iPad for their individual use. Students were also familiar with all the vocabulary terms included on the checklist, so that the purpose of the project was not to learn new vocabulary, but to demonstrate what they had learned throughout the school year. Students were to take pictures of real-life examples of various vocabulary terms using the camera on their iPads. Students were provided with a checklist (adapted from Kemberitzky, Victor, and Flanagan, 2011) of geometry terms they had used throughout the school year. The checklist included things like “vertical angles that are not perpendicular” so that students had to stretch themselves and could not just rely on finding multiple examples of perpendicular lines. Students had two major conditions for the pictures: each picture must be original to the student (meaning they could not download images from the internet or share pictures with their classmates) and each vocabulary term had to be found in structures that already existed. Students also were not allowed to simply tilt their iPad and then say that the lines were not horizontal or vertical. Creativity

was emphasized and students were encouraged to take the opportunity to find the most interesting examples of the vocabulary term they could find. Students were given one week to find examples of the vocabulary terms and take pictures with the iPad.

2.1 Geometry Scavenger Hunt

Checklist for Scavenger Hunt: You must find 12 ORIGINAL pictures from the list below.

- 2 parallel lines that are NOT horizontal or vertical
- 3 or more parallel lines that are not horizontal or vertical
- 2 parallel planes
- 2 parallel planes that are not horizontal or vertical
- Any skew lines
- Linear pair formed by lines that are NOT perpendicular
- Supplementary angles that are NOT adjacent
- Supplementary angles that are NOT adjacent and NOT right angles
- Vertical angles formed by two intersecting perpendicular lines
- Vertical angles formed by two lines that are NOT perpendicular
- Alternate exterior angles (AEA) where the parallel lines are horizontal or vertical and the transversal is NOT \perp
- AEA where the parallel lines are NOT horizontal nor vertical and the transversal is NOT \perp
- Corresponding angles where the parallel lines are horizontal or vertical and the transversal is NOT \perp
- Corresponding angles where the parallel lines are NOT horizontal nor vertical and the transversal is NOT \perp
- Consecutive interior angles (CIA) where the parallel lines are horizontal or vertical and the transversal is NOT \perp
- CIA angles where the parallel lines are NOT horizontal nor vertical and the transversal is NOT \perp
- Alternate interior angles (AIA) where the parallel lines are horizontal or vertical and the transversal is NOT \perp
- AIA where the parallel lines are NOT horizontal nor vertical and the transversal is NOT \perp
- A special right triangle (either a $45^\circ - 45^\circ - 90^\circ$ triangle or a $30^\circ - 60^\circ - 90^\circ$ triangle and you must be able to EXPLAIN how you know it's a special right triangle)
- Congruent triangles (you must be able to explain how you know the triangles are \cong)
- Similar triangles ((you must be able to explain how you know the triangles are similar)

Students were also required to edit each of the pictures they had taken to make the vocabulary terms easier to see. Students were shown how to crop pictures and rotate them as needed on the iPad. Once the pictures were oriented and cropped appropriately,

students used an iPad app called “Doodle Buddy” to illustrate the vocabulary term. This app allows the user to import pictures as a background and then draw on top of the image. For example, one student noticed that a sign for a pharmacy included an example of vertical angles. Once he imported the picture of the sign into the app, he drew in the two intersecting lines and then clearly labeled the vertical angles he saw (see Fig. 1). Students then had approximately one week outside of class to edit all of their photos and add illustrations on the iPad.



Fig. 1: Real-world example of vertical angles annotated with Doodle Buddy app on iPad

Finally, students took their edited photos and created a presentation using an app called Keynote, which is very similar to PowerPoint. Every slide was titled with the vocabulary word, and included the edited photo. Students were required to write one paragraph defining the vocabulary term in their own words (see Fig. 2) so that an incoming student could view their presentations on the first day of class next year and understand the new vocabulary. Students could also include information they had learned from theorems or postulates concerning the vocabulary. For example, many students explained in their paragraph about vertical angles that their measures will always be equal. Students turned in their presentations electronically.

Student response to the project was very positive. This iPad project gave students an outlet to be creative and apply what they had learned about geometry. Looking for real-life examples actually became a bit of a contest among the students! The Keynote presentations also made it very obvious that students understood the vocabulary used throughout the year. Their explanations of the vocabulary demonstrated their knowledge of the terms we had studied.

The iPad generated student interest in the material. This assignment focuses on conceptual understanding. Asking students to go out and find real-life example of vocabulary terms requires higher-level thinking than simply giving students a quiz on vocabulary. Students must truly understand the terms in order to find an example and explain it in their own words. The iPad activity used multiple representations. Each vocabulary term



Fig. 2: Student-produced Keynote slide

was defined both visually and in words. The use of multiple representations in mathematics classrooms is vital and can help students shift from procedural understanding to conceptual understanding, which will allow them to continue to be successful in high level mathematics courses.

3 Conclusion

Embracing technology in the mathematics classroom can lead to innovative ways of teaching and assessing students. When technological tools are used effectively, students are motivated and become active participants in the learning process. Technology also opens up new avenues of learning for teachers. With the tools available in the classroom today, teachers are able to focus more on conceptual understanding and can also provide students with visual representations of difficult topics. In particular, the iPad is radically revamping curriculum across the country. In the years to come, we will continue to learn even more ways to effectively integrate these tools into our classrooms.

References

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